OCT 1979

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification: B05C 19/02, B04C 13/00

A1

(11) International Publication Number: WO 79/00756

(43) International Publication Date: 4 October 1979 (04.10.79)

(21) International Application Number: PCT/GB79/00042

(22) International Filing Date: 8 March 1979 (08.03.79)

(31) Priority Application Number: 9968/78

(32) Priority Date: 14 March 1978 (14.03.78)

(33) Priority Country: GB

(71) Applicants: MALLATITE PLASTICS LIMITED; Haigh Avenue, Whitehill Industrial Estate, Stockport, Cheshire,United Kingdom *(for all designated States except US)*. TILLEY, Douglas Ronald; 311 Aspley Lane, Nottingham, United Kingdom *(for US only)*. WHITE, Peter Allan; 147 Stanley Road, Cheadle Hulme, Cheshire, United Kingdom *(for US only)*.

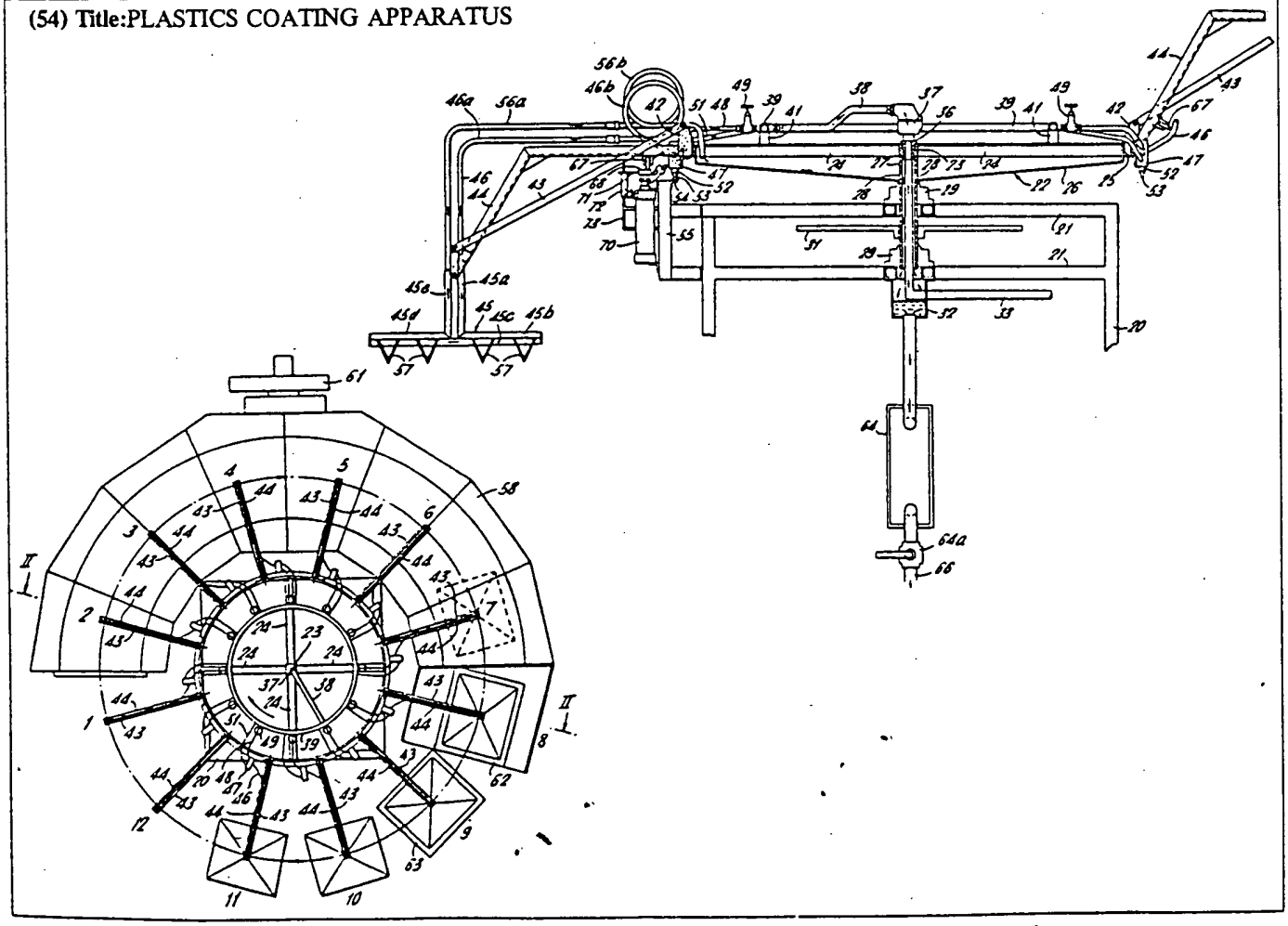
(72) Inventors: TILLEY, Douglas Ronald; 311 Aspley Lane, Nottingham, United Kingdom. WHITE, Peter Allan; 147 Stanley Road, Cheadle Hulme, Cheshire, United Kingdom.

(74) Agent: PRENTICE, Raymond Roy; 34 Tavistock Street, London, United Kingdom WC2E 7PB.

(81) Designated States: CH, DE, DE (Utility Model), DK, GB, JP, SE, US.

Published with:
International search report

(54) Title:PLASTICS COATING APPARATUS



(57)Abstract

Apparatus for coating articles with plastics material comprises a number of workholders (45) each consisting of a conduit and at least one jig (57) attached to the conduit. Each jig is adapted to support one or more articles to be coated. The apparatus further includes means for passing a continuous flow of cooling fluid through the conduits when the apparatus is in operation, an oven (58) for heating the articles on the workholders, a fluidizable bed (62)of plastics coating material and means for lowering the heated articles into the bed (62) for a predetermined period to allow coating of the articles to a predetermined thickness to take place and for subsequently lifting the articles from the bed. The lowering and lifting means comprise a parallelogram linkage consisting of a straight arm (43) and a cranked arm (44) for each workholder which is pivotally connected to its respective arms. The cranked arm (44) is arranged to be acted on by a pneumatic cylinder(70) whereby movement of the associated piston in one direction is effective to lower the and the associated workholder and movement of the piston in the other direction is effective to lift the arm and workholder. In operation of the apparatus, the workholders are moved through a circular path whereby at a first station the jigs are loaded with one or more articles, the workholders then pass through the oven (58) to heat the articles, each workholder is then brought in turn to a station at which the associated arm (44) is acted on by the cylinder (70) and the articles suspended from the workholder are lowered into the fluidized bed (62) and then lifted out of the bed, the articles are then allowed to cool and are finally removed from the jigs at an unloading station. The jigs and workholders are maintained at a temperature below the fusion point of the plastics material by the cooling means so that they are not coated while the articles are being coated with said plastics material.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT

AT	Austria	LU	Luxembourg
BR	Brazil	MC	Monaco
CF	Central African Empire	MG	Madagascar
CG	Congo	MW	Malawi
CH	Switzerland	NL	Netherlands
CM	Cameroon	RO	Roumania
DE	Germany, Federal Republic of	SE	Sweden
DK	Denmark	SN	Senegal
FR	France	SU	Soviet Union
GA	Gabon	TD	Chad
GB	United Kingdom	TG	Togo
JP	Japan	US	United States of America

Title: Plastics Coating Apparatus

This invention relates to the coating of articles with plastics materials. The invention is particularly concerned with holding devices for handling articles to be coated.

Articles can be coated with plastics material by heating said articles to a temperature above the fusion temperature of the coating material and then immersing said heated articles in a fluidized bed of the coating material. A serious problem associated with this method is that devices for holding the heated articles also tend to be heated and coated with the articles and this is undesirable.

Various methods have been tried in the past to prevent the holding devices from being coated with plastics material when the articles which they are holding are being coated. One such method is described in U.S. Patent Specification No. 3,440,078 in which an article holding device comprises a pair of tongs by means of which an article to be coated may be held. The tongs have jaws which form an air box or casing and which are porous for the discharge of air therethrough against the body of an article held therein. Means are provided for introducing air under pressure into the box and the air is introduced at a chilled or low temperature to minimize the absorption by the air box or casing of heat from the heated article to be coated and accordingly to prevent or reduce to a minimum the coating of the air box or casing. This arrangement requires the use of an expensive compressor in order to generate the compressed air and means must also be provided for cooling the compressed air flow. In addition to the expense, a further disadvantage is that the flow of compressed air must be very accurately controlled when the article held by the air box or casing is immersed in a fluidized bed of coating material if the article is to be coated properly.

Another method is disclosed in U.S. Patent Specification No. 3,226,245 in which an article to be coated is held in a holder which is hollow and through which water is passed in order to cool the holder. While this arrange-

ment is cheaper, it is not possible to coat the whole of an article to be coated in one operation because part of the article is masked by the cooled holder.

An arrangement for coating the whole of an article to be coated in one operation is disclosed in German Offenlegungsschrift No. 26 48 093 in which the article is suspended from a hollow jig which is connected to a holder in the form of a reservoir for a cooling liquid. In this case, there are no means for removing the cooling liquid from the jig and the liquid can only escape if it evaporates. In the case in which water is used, the boiling point of which is 100°C, the jigs can attain a temperature which is close to the fusion temperature of some plastics materials commonly used for coating (approximately 120°C). Very accurate control is therefore necessary if the jigs themselves are not to be coated entailing expensive control systems.

Yet another arrangement for the plastics coating of articles is disclosed in German Offenlegungsschrift No. 26 25 123 in which articles to be coated are suspended from hollow hooks connected by a feed pipe to a cooling unit in the form of a tank. The articles are heated in an oven and then the heated articles suspended from the hooks are coated with plastics material by raising a tank containing pulverized plastics into the path of movement of the articles suspended from the hooks. This arrangement can only be used for coating small light articles having a smooth configuration. Uniform coating of heavy articles or articles having a complex configuration cannot be achieved by this method. In order to achieve even and uniform coating, we have found that the articles must be moved within a tank containing pulverulent plastics material in a substantially horizontal direction and that the level of powder in the tank must remain substantially constant. If the tank is raised up to the articles, the powder starts to sway within the tank and it is not possible to achieve even and uniform coating. On the other hand, if the articles are lowered into a stationary tank the only movement of the powder is caused by disturbance of the articles moving

through the powder and even and uniform coating of the article can be achieved.

The present invention therefore aims to provide apparatus for coating articles with plastics material which overcomes the above mentioned disadvantages and which does not require the use of accurate and expensive control systems.

According to the invention, there is provided apparatus for coating articles with plastics material, said apparatus comprising at least one holder consisting of a conduit and at least one jig attached to the conduit, the or each jig being adapted to support one or more articles to be coated; means for passing a continuous flow of cooling fluid through the or each conduit when the apparatus is in operation; means for heating the or each article on the or each holder; a bed of plastics coating material; and means for lowering the heated article(s) into said bed for a predetermined period to allow coating of the article(s) to a predetermined thickness to take place and for subsequently lifting the article(s) from the bed, the lowering and lifting means being operatively connected to the holder(s) and including at least one pivotal arm to which the or a respective holder is pivotally connected. The bed of plastics coating material is preferably a fluidizable bed.

The cooling fluid is preferably water and a plurality of jigs are desirably detachably secured to the or each holder.

The invention will now be further described, by way of example, with reference to the drawings, in which:-

Figure 1 is a plan view which shows, diagrammatically, one embodiment of plastics coating apparatus according to the invention;

Figure 2 is a diagrammatic section taken on the line II-II in Figure 1; and

Figure 3 shows a detail of the apparatus shown in Figure 2 to an enlarged scale.

It will be noted that Figure 3 of the drawings shows the apparatus in more detail than the other two figures which show only those parts of the apparatus which are

necessary for an understanding of the manner in which the apparatus operates. For details of the cooling means for the work holders reference should be made to Figure 3 of the drawings.

Referring to the drawings, the apparatus comprises a central framework 20 above which is rotatably mounted an indexing table 22. The table 22 includes a central boss 23 and extending radially outwardly from said boss are four arms 24. A ring 25 of L-shaped cross-section is secured to the outer ends of the arms 24 and a circular tray 26 having a sloping base is secured to the ring 25. An aperture is provided in the tray 26 which is aligned with the boss 23 and through which extends a tube 27. The tube is secured, e.g. by welding, at one end to the boss 23 and is also secured to the tray in the region of the aperture therein. A number of holes 28 which serve as drain holes in a manner hereinafter described are provided in the wall of the tube 27 adjacent the bottom region of the tray 26 at which said aperture is located.

The tube 27 is mounted in bearings 29 which are mounted on webs 21 forming part of the framework 20 and a gear or like wheel 31 is secured on said tube between the two webs 21. The wheel 31 is arranged to be driven by suitable drive means (not shown) via a belt, chain or the like (not shown). The drive means are arranged to drive the wheel 31, and hence the tube 27 and indexing table 22 in stepping fashion and may comprise, for example, a Geneva wheel movement or an electric stepping motor.

Extending axially through the tube 27 is the upper end of a feed pipe 33 which is connected at its lower end to the output from a pump 34. The inlet to said pump is in communication with a water tank 35. The pipe 33 is held against rotation and the boss 23 is rotatably mounted on the upper end of this pipe by means of a plain sleeve bearing 36. A rotary pipe union 37 is mounted on the said upper end of the pipe 33, the pipe union consisting of a fixed part which is mounted on the pipe 33 and a rotatable part which is mounted on, but is rotatable with respect to, the fixed

part. A feed pipe 38 leads from the rotatable part of the pipe union 37 to a ring feed pipe 39 which is mounted on the indexing table by means of stanchions 41 secured to the arms 24.

Secured to the ring 25 at equally spaced intervals are a series of twelve blocks 42 on each of which is pivotally mounted a respective parallelogram linkage consisting in each case, of a straight arm 43 and a pantograph type cranked arm 44. A respective workholder 45 is pivotally connected to the other ends of the arms 43 and 44.

As shown in Figure 3 of the drawings, each workholder 45 consists of a conduit having a vertical feed section 45a, an upper horizontal feed section 45b, a lower horizontal section 45c, an upper horizontal return section 45d and a vertical return section 45e. A feed pipe 46 is connected between the feed section 45a and a valve 47. Each valve 47 is connected to the ring feed pipe 39 by a first feed pipe 48 in which a regulating gate valve 49 is provided and by a second feed pipe 51 in which no valve or control is provided. Each valve 47 is normally in a position in which only a regulated flow from the associated feed pipe 49 is allowed to pass through it but is provided with a control device 52 which, when operated, opens a port in the valve to allow full flow from the pipe 51 to pass through said valve 47. The operation of the control device 52 is described hereinafter. A return pipe 56 leads from the return section 45e of the workholder into the tray 26 of the indexing table. Each return pipe preferably consists of a rigid portion 56a and a flexible portion 56b. Similarly, each feed pipe 46 preferably consists of a rigid portion 46a and a flexible portion 46b. In each case, the rigid portions of the pipes 46 and 56 are connected to the work holder. A plurality of jigs 57 (in this case four) are secured to each workholder 45 (Fig. 2) and preferably have a large area of contact with the associated workholder in order to facilitate cooling of the jigs in a manner hereinafter described.

Turning now to Figure 1 of the drawings, it will be seen that each of the sets of arms 43, 44 occupies one of twelve

stations 1 to 12 of the apparatus. Station 1 is a loading station at which articles to be coated with plastics material are suspended from the jigs 57 on the workholder at that station. Stations 2 to 7 are located in an arcuate oven 58 which is designed to heat articles on the jigs to a temperature of from 350°C to 450°C. The heating means for the oven may comprise a number of gas burners 59 located in a duct 60 extending from one side of the oven to the other. An air circulating fan or blower 61 is located between the outlet from the oven and the inlet to the duct 60 to force air through the burners 59 and then into the oven 58. Preferably, direct heating takes place only at stations 2 to 5 while "soaking" takes place at stations 6 and 7. A fluidizable bed 62 of plastics coating material is located at station 8 and a cooling tank 63 is located at station 9. Air cooling means (not shown) are provided at station 10 and station 11 is an unloading station at which coated articles can be removed from the jigs. Station 12 is an idle station at which unloading can be completed if necessary and, if desired, loading commenced.

When the apparatus is required for use, the burners 59 and fan or blower 61 for heating the oven 58 are turned on, the bed 62 is fluidized, the cooling means at station 10 are rendered operative and the pump 34 is switched on. The pump delivers water from the tank 35 up the feed pipe 33 through the pipe union 37 and feed pipe 38 to the ring feed pipe 39. From the ring pipe 39, the water is pumped through the regulator valves 49 and feed pipes 48 (in some cases also through the second feed pipes 51 as described hereinafter), through the valves 47 and feed pipes 46 to the workholders 45. The water passes through each of the sections 45a, 45b, 45c, 45d and 45e of the workholders and is then pumped along the return pipes 56 to discharge into the tray 26 of the indexing table 22. The water leaves the tray through the drain holes 28 and passes down the tube 27 into a collection tank 32 and thence into a cooling system comprising a cooling radiator 64 which is arranged to be cooled by a fan 65. After being cooled by the cooling system, the

water is returned to the tank 35 for re-circulation via a pipe 66, the flow of water through said pipe, and hence through the radiator 64, being controlled by a valve 64a.

Once the jigs 57 on the workholder 45 at station 1 have been loaded with articles to be coated and the oven has attained the desired working temperature (350-450°C), the drive means are started and the loaded workholder is moved from station 1 to station 2 owing to the rotation of the indexing table under the action of the drive means. Rotation of the indexing table is then stopped for a predetermined period.

As the workholder is moved from station 1 to station 2, a roller 67 on the arm 44 is in engagement with a cam track (not shown) which ensures that the arms 43 and 44 are maintained in the raised position indicated at the right hand side of Figures 2 and 3.

Further indexing steps of the table 22 bring the workholder in turn to stations 3, 4 and 5 at each of which the burners 59 in the oven serve to heat the articles to be coated to the desired temperature. At the same time, the jigs 57 are kept at a lower temperature by virtue of the flow of cooled water through the workholder. At the next step, the workholder is brought to station 6 at which no direct heating is applied, but the articles are allowed to "soak" in the heat in the oven.

The workholder is brought at the next step to station 7 and at this point a roller 53 on the control device 52 engages a cam track 54 mounted on supports 55 which are secured to the framework 20. The engagement of the roller 53 with the cam track 54 causes the control device 52 to open the valve 47 to permit unrestricted flow of water through the feed pipe 51 to pass through the valve 47 and feed pipe 46 to the workholder 45. Thus, while the workholder remains in the oven at station 7 its cooling is rendered more effective by the increased flow of cooling water through it. As a result, the cooling of the jigs is increased while the articles on the jigs continue to "soak" in the heat in the oven. The cooling of the workholder does, however, result

in some cooling of the articles, the temperature of which is reduced to about 250°C, but this is still well above the fusion temperature of plastics coating materials.

At the next step, the workholder is moved out of the oven to station 8 at which the fluidized bed 62 of plastics coating material is located. The cam track which is engaged by the roller 67 on arm 44 ends at this station and the roller moves onto a pad 68 which is provided on the end of a piston rod 69 of a pneumatic ram or lifting cylinder 70. The cylinder is actuated to retract the piston whereby the piston rod 69 and pad 68 are lowered which allows the arms 43, 44 and the workholder 45 to be lowered so that the workholder is lowered into the bed 62 as shown in Figure 2. The workholder 45 is allowed to remain in the lowered position, in which the jigs and articles are immersed in the fluidized bed of coating material, for a predetermined period to allow for coating of the heated articles to a predetermined desired thickness after which the cylinder 70 is actuated to force the piston rod 69 upwards. This upwards movement of the piston rod 69 causes in turn the arm 44 and hence the workholder 45 to be moved upwards out of the bed 62. The workholder is then preferably subjected to agitating means to shake off loose particles from the coating which loose particles are returned to the bed. Since the workholder is cooled by an unrestricted rapid flow of cooling water through it, both said workholder and the jigs held thereon are maintained below the fusion temperature (120°C) of the coating material and thus are not coated with the plastics material. Any loose powder collected on the workholder and/or jigs is shaken off by the agitation which may be accomplished by rapid actuation of the lifting cylinder 70 in both directions although other agitation means may be employed if desired.

The workholder is next indexed to station 9 at which it is lowered into the cooling tank 63 of water or other cooling fluid in a similar manner to lowering the workholder into the fluidized bed 62. The cam track 54 ends at this point and the roller 53 is therefore allowed to drop down

so that the control device 52 is effective to close the inlet from the feed pipe 51 to the valve 47. The flow of cooling water through the workholder 45 is thereafter reduced to the controlled flow permitted by the regulator valve 49. The time during which the workholder remains in the cooling tank is so regulated that the residue of heat in the components will tend to dry off the coolant once the workholder is lifted out of said tank. At the end of said time, the arm 44 is raised by a lifting cylinder similar to the cylinder 70 to raise the workholder clear of the tank before the next indexing step when the workholder is moved to station 10 at which said workholder and the associated jigs and articles are cooled and additionally dried by one or more air jets. At the same time, the roller 67 is again engaged with the first-mentioned cam track (not shown) whereby the arms 43 and 44 are again maintained in the raised position. This cam track extends from between stations 9 and 10 right round through stations 11 to 6 to between stations 7 and 8. During raising and lowering of the arms 43 and 44, the workholder is displaced vertically under the action of the parallelogram linkage.

The workholder is next moved to station 11 at which the coated articles are unloaded from the jigs. If not completed at this station, the unloading can be completed at station 12 at which loading can also be commenced.

The jigs 57 are preferably detachedly mounted on the workholder whereby they may be replaced by others more suitable for use with any particular article to be coated and can also be removed for cleaning and/or replacement.

As shown in Figure 2, the arcuate oven 58 is preferably provided with an arcuate slot 74 in its roof which permits the passage of the workholder 45. The oven is designed to heat articles to be coated to a temperature of 350-450°C in order to burn off any traces of oil and grease on the articles to be coated which can interfere with adhesion of the coating material to the articles.

The return pipes 56 may be replaced or supplemented by steam escape pipes if desired but this is not preferred.

Preferably, means (not shown) are provided for moving the articles horizontally while they are immersed in the plastics coating material to provide a more even coating.

The apparatus may further be provided with means for varying the depth to which articles suspended from the jigs are lowered into the fluidized bed 62. This is particularly useful when large articles are to be coated since they have to be lowered further into the bed than small articles in order to be coated. Further, if only part of an article is to be coated with plastics material, this can be achieved by arranging the article on a jig so that the part to be coated is lowermost and by lowering the article to such an extent that only the part to be coated is located in the fluidized bed 62.

The means for varying the lowering depth of the articles may comprise a valve 72 which is actuable by an extension member 71 secured to the pad 68. The valve is so arranged that, when it is engaged by the extension member 71 it is effective to stop the movement of the cylinder 70 in the direction in which said cylinder is operative to lower articles suspended from the jigs into the fluidized bed 62. The valve can be mounted on a vertical rod 73 and can be adjustable on said rod to vary the position at which it is contacted by the extension member 71. Thus, the lower the valve 72 is located on the rod 73, the deeper will the articles be lowered into the bed 62 and raising the position of the valve 72 on the rod 73 will reduce the lowering depth of the articles into the fluidized bed 62. Just as the cooling tank 63 may be provided with a lifting cylinder similar to the cylinder 70, so this cylinder may also be provided with a valve arranged to operate in a similar manner to the valve 72 in order to adjust the depth to which articles are lowered into the cooling tank 63.

If it is not desired to cool the articles too quickly, the step of lowering them into the cooling tank may be omitted. This may be achieved either by removing the cooling tank or leaving it empty or by preventing the cylinder associated with the cooling tank from operating so that the

CLAIMS

1. Apparatus for coating articles with plastics material, said apparatus comprising at least one holder consisting of a conduit and at least one jig attached to the conduit, the or each jig being adapted to support one or more articles to be coated; means for passing a continuous flow of cooling fluid through the or each conduit when the apparatus is in operation; means for heating the or each article on the or each holder; a bed of plastics coating material; and means for lowering the heated article(s) into said bed for a predetermined period to allow coating of the article(s) to a predetermined thickness to take place and for subsequently lifting the article(s) from the bed, wherein the lowering and lifting means are operatively connected to the holder(s) and include at least one pivotal arm to which the or a respective holder is pivotally connected.

2. Apparatus according to claim 1, wherein the or each arm is pivotally mounted on a movable conveyor means.

3. Apparatus according to claim 2, wherein the movable conveyor means comprise a rotatably mounted table on which a plurality of said arms, each carrying an associated holder, are pivotally mounted.

4. Apparatus according to claim 3, wherein the table is arranged to be rotated intermittently in steps corresponding in number to the number of holders pivotally connected to said table.

5. Apparatus according to claim 3 or claim 4, wherein the heating means comprise an oven arcuately arranged around part of the periphery of said table.

6. Apparatus according to claim 5, wherein the oven takes the form of an arcuate tube having a slot to accommodate the passage of the arms when the associated holders are advanced through the oven.

7. Apparatus according to any one of claims 3 to 6, wherein the means for passing cooling fluid through the conduit comprise a pump and a feed pipe connected to the output from the pump and leading to the conduits.

Preferably, means (not shown) are provided for moving the articles horizontally while they are immersed in the plastics coating material to provide a more even coating.

The apparatus may further be provided with means for varying the depth to which articles suspended from the jigs are lowered into the fluidized bed 62. This is particularly useful when large articles are to be coated since they have to be lowered further into the bed than small articles in order to be coated. Further, if only part of an article is to be coated with plastics material, this can be achieved by arranging the article on a jig so that the part to be coated is lowermost and by lowering the article to such an extent that only the part to be coated is located in the fluidized bed 62.

The means for varying the lowering depth of the articles may comprise a valve 72 which is actuable by an extension member 71 secured to the pad 68. The valve is so arranged that, when it is engaged by the extension member 71 it is effective to stop the movement of the cylinder 70 in the direction in which said cylinder is operative to lower articles suspended from the jigs into the fluidized bed 62. The valve can be mounted on a vertical rod 73 and can be adjustable on said rod to vary the position at which it is contacted by the extension member 71. Thus, the lower the valve 72 is located on the rod 73, the deeper will the articles be lowered into the bed 62 and raising the position of the valve 72 on the rod 73 will reduce the lowering depth of the articles into the fluidized bed 62. Just as the cooling tank 63 may be provided with a lifting cylinder similar to the cylinder 70, so this cylinder may also be provided with a valve arranged to operate in a similar manner to the valve 72 in order to adjust the depth to which articles are lowered into the cooling tank 63.

If it is not desired to cool the articles too quickly, the step of lowering them into the cooling tank may be omitted. This may be achieved either by removing the cooling tank or leaving it empty or by preventing the cylinder associated with the cooling tank from operating so that the

БЮРЕАУ

coated articles are not lowered into the cooling tank.

Other embodiments and modifications are possible without departing from the scope of the invention as defined by the appended claims. For example, if thermosetting plastics are being used as the coating materials, a curing stage is required between stations 8 and 9 but this is not required for thermo-plastics materials. Moreover, although the above description relates to intermittent operation, it is also possible for the apparatus to operate continuously and the invention is not restricted to intermittent operation. Further, the pump 34 may be arranged to supply a continuous flow of cooling liquid to the cooling tank 63 in order to prevent the cooling liquid from being over-heated by the hot coated articles which are lowered into it. The cooling tank may be included in the cooling system whereby it receives a continuous supply of cooled water from the pump 34. However, it is also possible to connect the feed pipe 33 direct to the water main so that the cooling water is supplied direct from the mains and the pump and cooling system can be dispensed with. In this case, the cooling tank can also be supplied with a steady flow from the mains. According to a further alternative, a circulating system for the cooling water may be provided as shown in the drawings but without a cooling system and with provision for adding some water from the mains and allowing some of the heated water to overflow to waste whereby a continuous supply of cooling water is furnished. In yet another alternative, the cooling tank may be dispensed with and the cooling achieved by spraying.

CLAIMS

1. Apparatus for coating articles with plastics material, said apparatus comprising at least one holder consisting of a conduit and at least one jig attached to the conduit, the or each jig being adapted to support one or more articles to be coated; means for passing a continuous flow of cooling fluid through the or each conduit when the apparatus is in operation; means for heating the or each article on the or each holder; a bed of plastics coating material; and means for lowering the heated article(s) into said bed for a predetermined period to allow coating of the article(s) to a predetermined thickness to take place and for subsequently lifting the article(s) from the bed, wherein the lowering and lifting means are operatively connected to the holder(s) and include at least one pivotal arm to which the or a respective holder is pivotally connected.

2. Apparatus according to claim 1, wherein the or each arm is pivotally mounted on a movable conveyor means.

3. Apparatus according to claim 2, wherein the movable conveyor means comprise a rotatably mounted table on which a plurality of said arms, each carrying an associated holder, are pivotally mounted.

4. Apparatus according to claim 3, wherein the table is arranged to be rotated intermittently in steps corresponding in number to the number of holders pivotally connected to said table.

5. Apparatus according to claim 3 or claim 4, wherein the heating means comprise an oven arcuately arranged around part of the periphery of said table.

6. Apparatus according to claim 5, wherein the oven takes the form of an arcuate tube having a slot to accommodate the passage of the arms when the associated holders are advanced through the oven.

7. Apparatus according to any one of claims 3 to 6, wherein the means for passing cooling fluid through the conduit comprise a pump and a feed pipe connected to the output from the pump and leading to the conduits.

8. Apparatus according to claim 7, wherein the feed pipe is connected to a rotary pipe union which in turn is connected to a ring pipe feed mounted on the table for rotation therewith, the conduits being connected to said ring pipe feed.

9. Apparatus according to claim 8, wherein each conduit is connected to the ring pipe via a valve allowing restricted flow in some radial positions of the associated conduit and unrestricted flow in other radial positions of the said associated conduit.

10. Apparatus according to any one of claims 7 to 9, wherein a return pipe leads from each of the conduits to the table which is constructed in the form of a tray.

11. Apparatus according to claim 10, wherein the tray is provided with drainage means leading to a cooling system for cooling the fluid returned from the conduits.

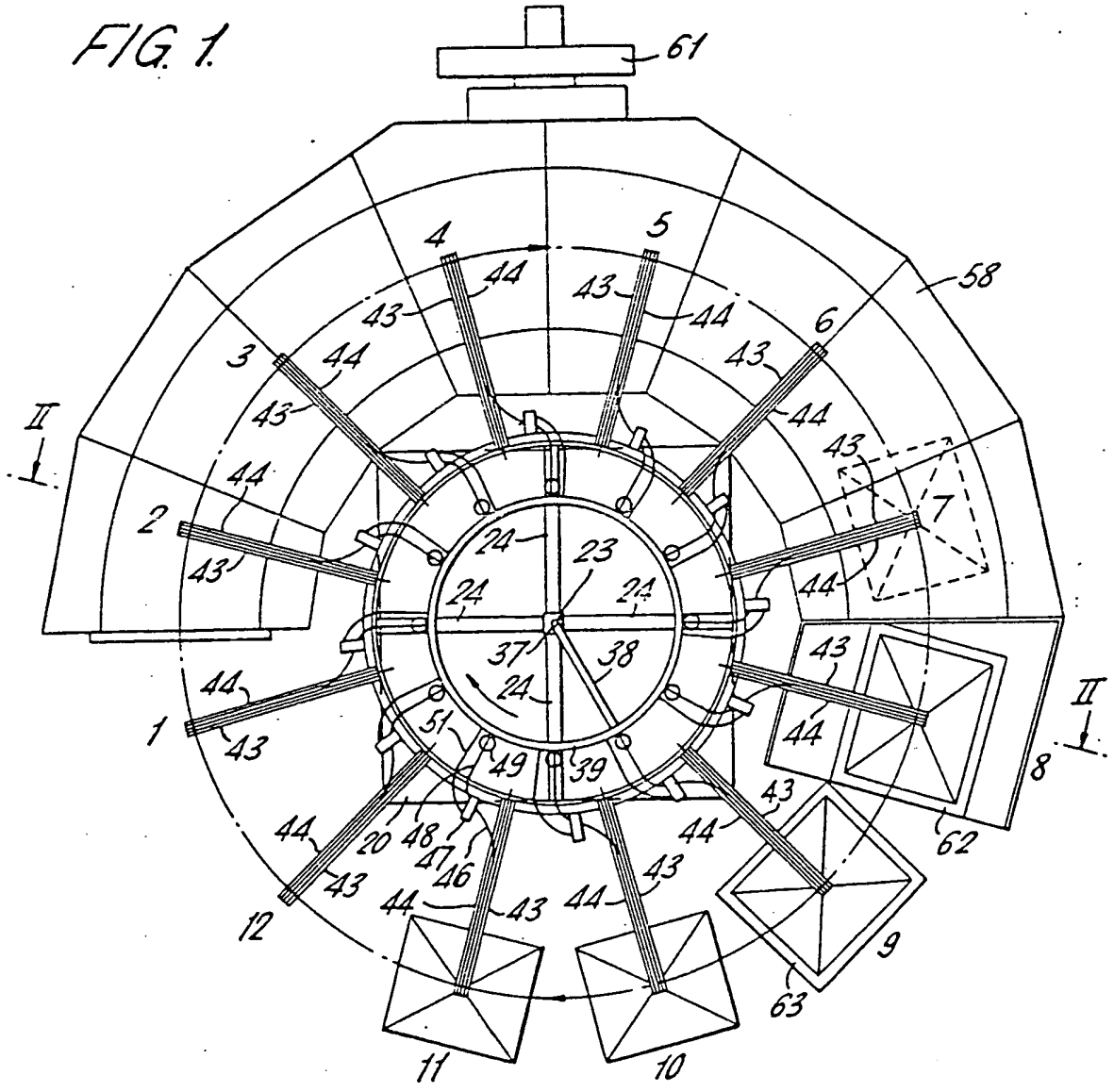
12. Apparatus according to claim 11, wherein the fluid cooled by the cooling system is fed to a tank from which the pump receives its supply.

13. Apparatus according to any one of claims 3 to 12, wherein the lifting means include a pneumatic ram or lifting cylinder engageable with each arm in turn as said table is rotated.

14. Apparatus according to any preceding claim, wherein the or each holder is provided with a plurality of jigs detachably secured thereto.

15. Plastics coating apparatus substantially as described herein with reference to the drawings.

FIG. 1.



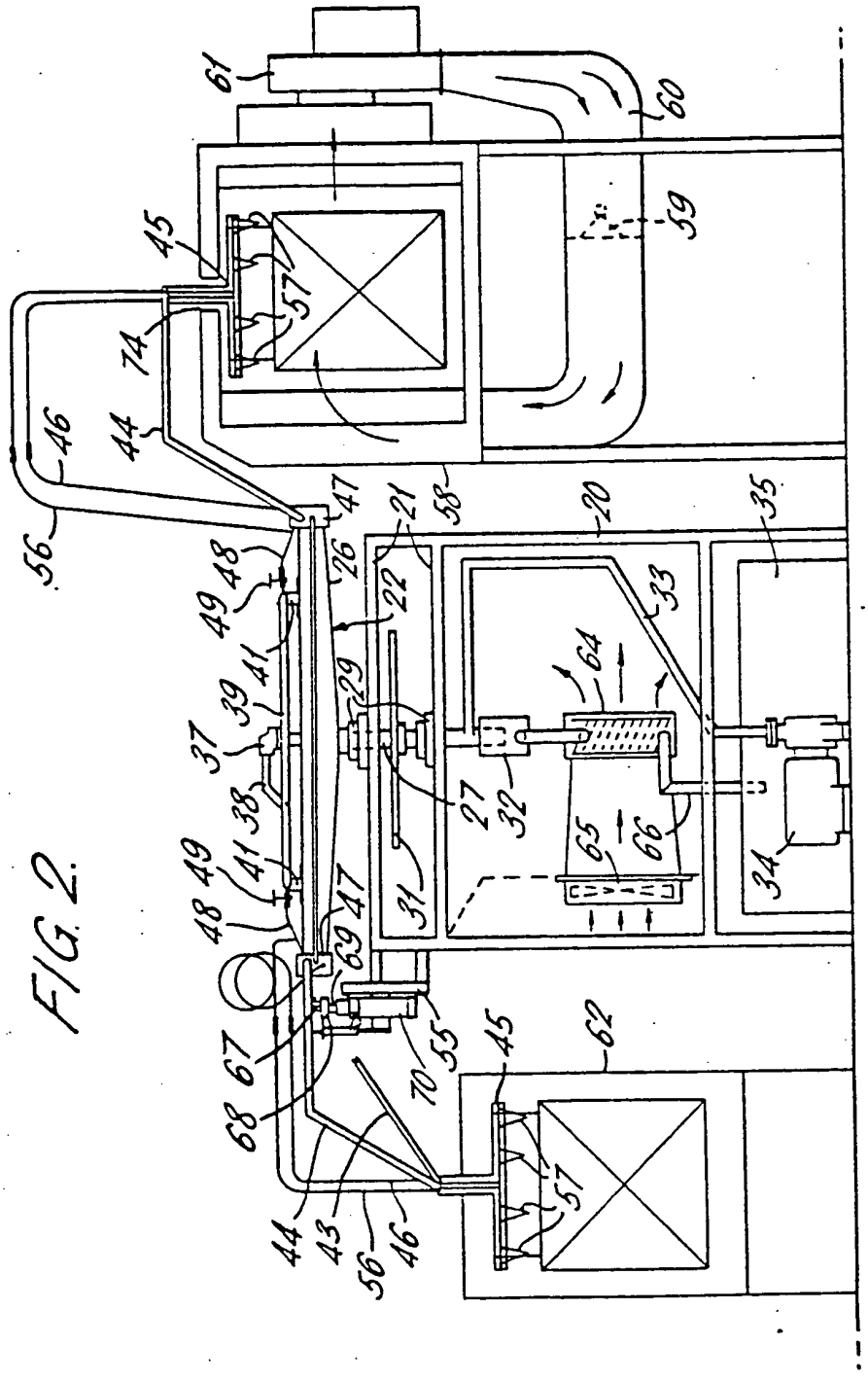


FIG 2.

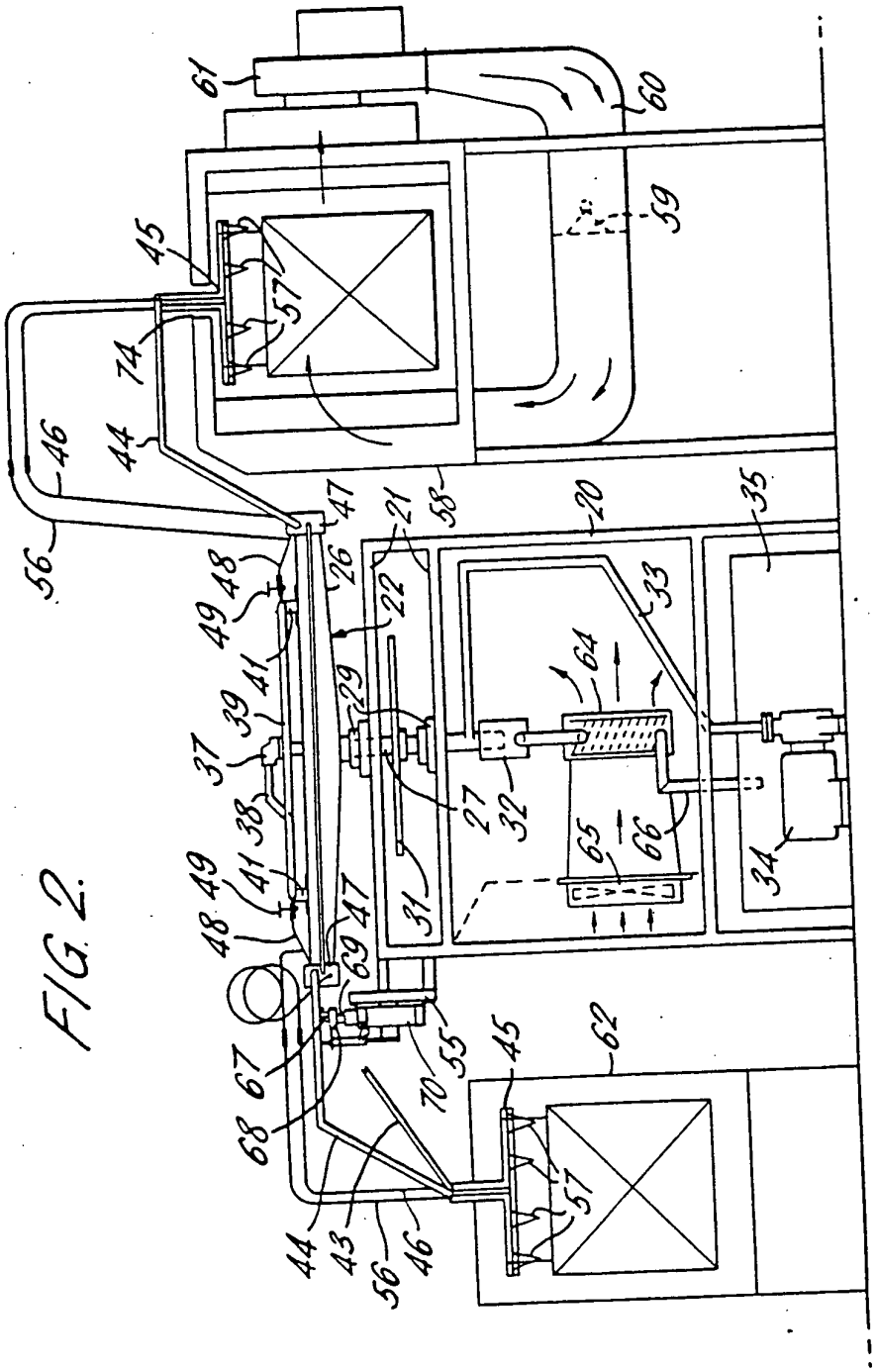


FIG 2.

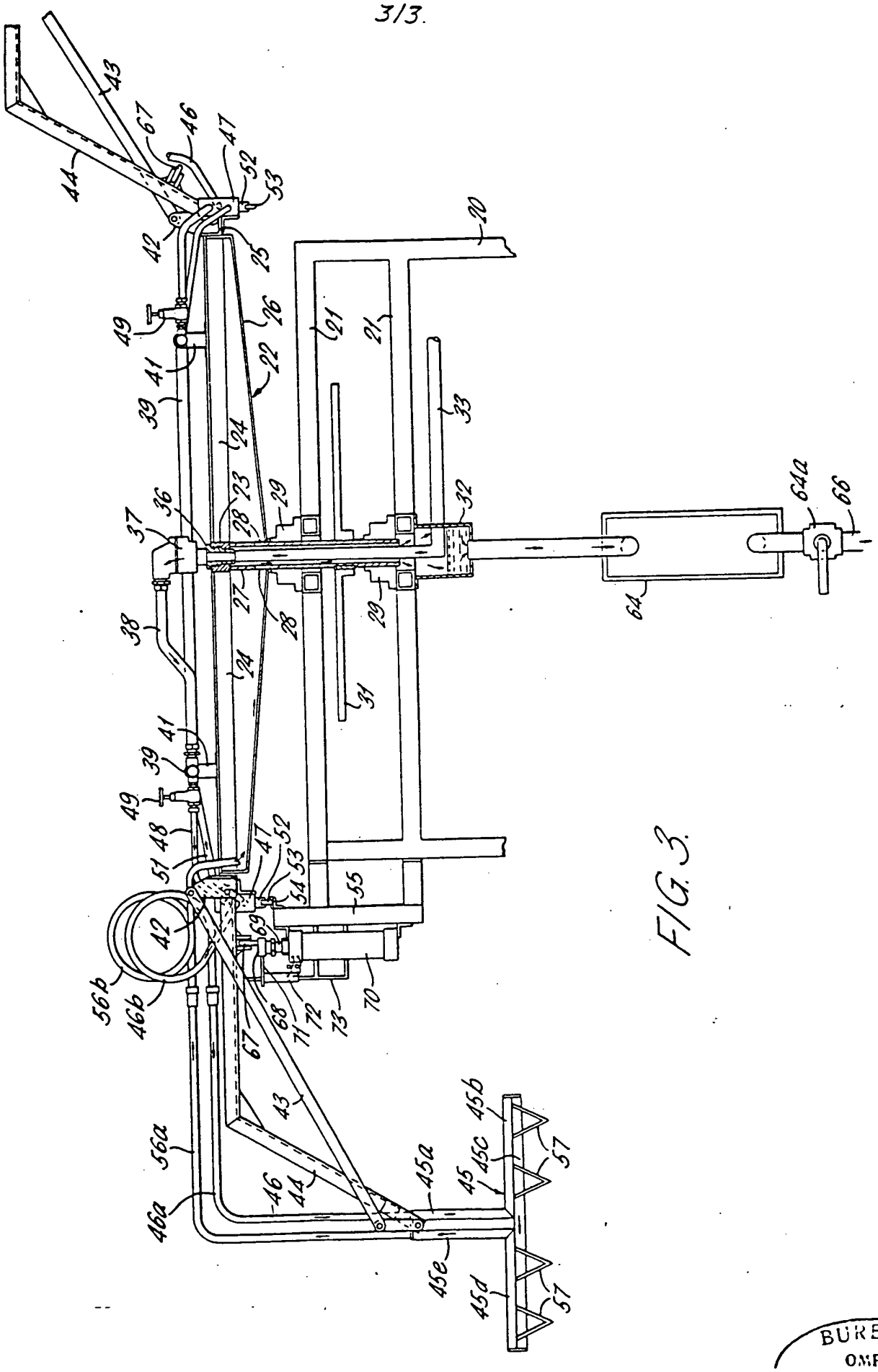


FIG. 3.